Cold DD fusion in conducting crystals

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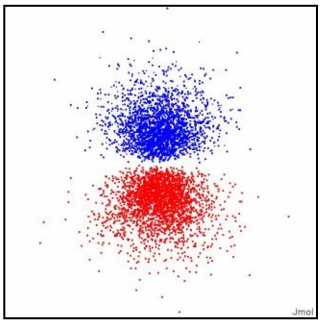
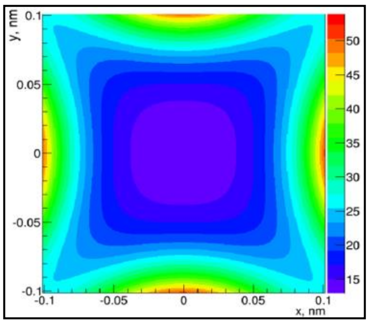
This report explains the mechanism of the so-called DD cold nuclear fusion during saturation of heavy metal crystals with deuterium atoms [1]. The process begins with excitation of deuterium atoms at the entrance to the crystal from the ground state ***1s***, which happens to be incompatible because of the obvious presence of free conduction electrons in the crystal niche, into one of the ***p***-states. Additional energy of about 10 eV, which is needed to do so, is quite comparable to the energy of immersion of deuterium ions in the solid. ***2p*** deuterium orbital and the potential configuration of an octahedral (deepest) niche are shown here on the attached figures. The ***p***-orbitals of the deuterium atom, after its entry into the crystal, are fixed in the niches in one of three possible spatial positions in the projection of X, Y, Z. When most of the niches are filled with deuterium atoms, the process of further saturation of the crystal produces the niches, in which two such atoms are located usually in a “crosswise” configuration In this case, the distance between these two deuterium nuclei may be less than 1/10 of the nominal size of the unexcited atom. Then, the quantum vibrations of these two deuterium nuclei in the potential niche lead to a sharp (60-65 orders of magnitude) increase in the probability of fusion of deuterium nuclei. This process is very similar to the so-called μ-catalysis.





During the low-energy (thermal) process of fusion, an intermediate nucleus $^4He^*$ is in a metastable state, due to the presence of residual Coulomb repulsion between its D-constituents. The discharge of this state with the emission of gamma rays is prohibited, since the system’s orbital momentum ***ℓ*** is equal to zero. During the time of existence of this metastable state, the discharge of the excess binding energy 24 MeV of $^4He^*$ nucleus into the crystal environment occurs via *virtual photons*, generating during these processes a few hundred 5-10 keV electrons in the host crystal for one act of DD-fusion.

We believe that similar mechanisms happen in other known cases of nuclear cold fusion.

[1] E.N. Tsyganov, M.D. Bavizhev, M.G. Buryakov, S.B. Dabagov, V.M. Golovatyuk, S.P. Lobastov, “Cold nuclear fusion”, http://dx.doi.org/10.1016/j.nimb.2015.01.039.

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